

AD_____

Award Number: DAMD17-00-1-0262

TITLE: Genetic Counseling for Breast Cancer Susceptibility
in African American Women

PRINCIPAL INVESTIGATOR: Chanita Hughes, Ph.D.

CONTRACTING ORGANIZATION: University of Pennsylvania
Philadelphia, Pennsylvania 19104-6205

REPORT DATE: February 2005

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

20050603 093

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 074-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE February 2005	3. REPORT TYPE AND DATES COVERED Annual (22 Jan 04 - 21 Jan 05)	
4. TITLE AND SUBTITLE Genetic Counseling for Breast Cancer Susceptibility in African American Women			5. FUNDING NUMBERS DAMD17-00-1-0262	
6. AUTHOR(S) Chanita Hughes, Ph.D.				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Pennsylvania Philadelphia, Pennsylvania 19104-6205 E-Mail: Chanita@mail.med.upenn.edu			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited				12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 Words) Increasingly, the cultural beliefs and values of women are being recognized as important factors in genetic counseling for breast cancer susceptibility. Despite recommendations to increase the cultural sensitivity of genetic counseling, such programs have not been developed or evaluated. The objectives of this study are to develop a Culturally Tailored Genetic (CTGC) protocol for African American women and evaluate its impact on decision-making and satisfaction about BRCA1/2 testing, quality of life, and cancer control practices. A secondary objective of this study is to identify African American women who are most and least likely to benefit from CTGC vs. SGC. The key research accomplishments achieved during the past year include continuing subject recruitment, completing genetic counseling and education, and generating peer-reviewed manuscripts. The results generated during the past year demonstrate that it is possible to enroll African American women into genetic counseling research. Our findings also demonstrate that African American women at increased risk for hereditary breast cancer report positive attitudes about the benefits of genetic testing; however, these attitudes may not translate into high levels of interest in testing. CTGC may be one strategy for addressing beliefs about genetic testing and facilitating testing decisions among African American women.				
14. SUBJECT TERMS Behavioral/Psychosocial Research, BRCA1/2, Decision-Making, Quality of Life				15. NUMBER OF PAGES 52
				16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

Table of Contents

Cover.....	1
SF 298	2
Table of Contents.....	3
Introduction.....	4
Body	4
Key Research Accomplishments	7
Reportable Outcomes.....	8
Conclusions.....	9
References.....	9
Appendices.....	10

A. INTRODUCTION

Five to 10% of all breast cancer cases have been attributed to two breast-ovarian cancer susceptibility genes called BRCA1 and BRCA2 (BRCA1/2). Genetic counseling and testing for BRCA1/2 mutations is now available through clinical research programs using standard counseling protocols. The goal of pre-test counseling is to facilitate informed decision making about whether to be tested and to prepare participants for possible outcomes. The goal of post-test counseling is to provide information about risk status, recommendations for surveillance, and options for prevention. However, previous research suggests that African American and Caucasian women differ in their attitudes about and responses to pre-test education and counseling (Hughes et al., 1997; Lerman et al., 1999). Increasingly, the cultural beliefs and values of participants are being recognized as important factors in genetic counseling. Despite recommendations to increase the cultural sensitivity of breast cancer risk counseling, such programs have not been developed or evaluated. Therefore, the purpose of this study is to develop a Culturally Tailored Genetic Counseling (CTGC) protocol for African American women and evaluate its impact on psychological functioning and health behaviors compared with Standard Genetic Counseling (SGC) in a randomized clinical trial. This research is linked with Dr. Hughes' Career Development Award and has the following primary technical objectives:

(1) To evaluate the relative impact of CTGC vs. SGC on decision-making and satisfaction about BRCA1/2 testing. Compared to SGC, CTGC will lead to higher rates of test acceptance and satisfaction with testing decisions. These effects will be mediated by increases in perceived benefits and decreases in perceived limitations and risks of genetic testing.

(2) To evaluate the impact of CTGC vs. SGC on quality of life and health behaviors following BRCA1/2 testing. Compared to SGC, CTGC will lead to larger decreases in general and cancer-specific distress, greater increases in adherence to cancer screening guidelines, and lower rates of prophylactic surgery. Reductions in psychological distress will be mediated by increased use of spiritual coping strategies.

Secondary Aim

To identify African American women who are most and least likely to benefit from CTGC vs. SGC. We predict that the relative benefits of CTGC will be greatest for women with greater endorsement of African American cultural values and those identified as BRCA1/2 carriers.

B. BODY

The research was transferred to the University of Pennsylvania Medical Center in February 2002 and approval for the use of human subjects was provided in February 2003. The third year of the study focused on (1) continuing subject recruitment, (2) completing genetic counseling and education sessions, and (3) generating peer-reviewed manuscripts. These activities are described in detail in the sections 1 through 3 below. Manuscripts that have been generated with grant support are described in section 3. This project is linked with Dr. Hughes' Career Development Award (CDA) and activities regarding professional development are described in section 4.

Summary of Accomplishments During the Past Year

(1) Subject Recruitment. Eligible subjects are African American women ages 18 and older who have a 5%-10% prior probability of having a BRCA1/2 mutation based on their personal and family history of breast and/or ovarian cancer. Eligible subjects are identified by referrals through mammography and oncology clinics located at the University of Pennsylvania and through the community-based referral network that was developed specifically for the study. Following referral, eligible women are mailed an invitation letter that includes information about the purpose of the study and a reply card for women to return if they are not interested in participating in the study. Women who do not return a reply card declining study participation are contacted by telephone to complete a structured baseline telephone interview. This interview takes approximately forty minutes to complete and includes measures of sociodemographic characteristics, personal and family history of cancer, perceived risk of having a BRCA1/2 gene alteration, and psychological functioning. Following completion of the baseline telephone interview, eligible subjects are invited to participate in pre-test education and counseling. Those who agree to participate in this session are randomly assigned to receive Standard Genetic Counseling (SGC) or Culturally Tailored Genetic Counseling (CTCG). Written informed consent is obtained for participation in pre-test education and counseling. After completion of the pre-test education session, subjects who are interested in genetic testing for BRCA1/2 mutations are given an opportunity to consider their decision further and have an opportunity to meet individually with a medical oncologist as part of the standard and culturally tailored genetic counseling protocols. After the meeting with the medical oncologist, blood is drawn for genetic testing after obtaining written informed consent. Once BRCA1/2 test results are available, test results are disclosed using the protocol that is consistent with the format used to provide pre-test education and counseling (SGC or CTCG).

Accrual and Response Rates. To date, a total of 228 eligible subjects have been identified and of these, 141 (62%) completed the baseline telephone interview and agreed to participate in the study, 47 (21%) declined to participate in the study, 33 (14%) could not be reached after multiple attempts, and 7 (3%) are pending contact. In terms of sociodemographic characteristics for women who enrolled in the study, most are under age 50 (61%) (Mean (SD) age = 46.69 (11.6)), not married (68%), have some college education or are college graduates (71%), and are employed (65%).

(2) Genetic Counseling and Education. Of the 141 eligible women who have enrolled in the study, 119 (84%) agreed to participate in pre-test education and counseling and 22 (16%) declined to participate in pre-test education and counseling. Of the 119 women who agreed to participate in pre-test education and counseling, 65 (55%) have been randomized to SGC and 54 (45%) have been randomized to CTGC. A total of 60 pre-test education and counseling sessions have been completed, 45 women declined pre-test education and counseling, and 14 women are pending completion of pre-test education and counseling. Of the women who completed pre-test education and counseling, 28 (47%) provided a blood sample for genetic testing, 22 (37%) are pending a decision regarding testing, and 10 (17%) declined genetic testing. Of the women tested, 19 (68%) received BRCA1/2 test results (4 mutation carriers, 9 noncarriers, and 6 ambiguous) and results are pending for 9 women.

(3) Manuscripts.

Attitudes about Genetic Testing and Genetic Testing Intentions in African American Women at Increased Risk for Hereditary Breast Cancer (Kessler L, Collier A, Brewster K, Smith C, Weathers B, Wileyto EP, Halbert CH, Genetics in Medicine, In Press). Although attitudes about genetic testing have been evaluated among African American women at low risk for hereditary breast cancer in previous research (Hughes et al., 1997), limited information is available on attitudes about the benefits, limitations, and risks of genetic testing among African American women at high and moderate risk for having a BRCA1 and BRCA1 (BRCA1/2) mutation. The purpose of this study was to evaluate attitudes about the benefits, limitations, and risks of genetic testing for BRCA1/2 mutations and to explore testing intentions in African American women at increased risk for hereditary breast cancer. Attitudes and intentions were evaluated by telephone in African American women (n=74) at increased risk for having a BRCA1/2 mutation. Overall, attitudes about the benefits of genetic testing were endorsed at higher rate relative to limitations and risks; however, only 30% of respondents indicated that they would definitely have testing. In regression analysis, women most likely to be considering testing were those with fatalistic beliefs about cancer (Odds Ratio=5.07, 95% Confidence Interval=1.42, 18.12, p=.01) and those who believed that they had a BRCA1/2 mutation (Odds Ratio=7.48, 95% Confidence Interval=2.10, 26.60, p=.002). Women who had two or more relatives affected with cancer were also most likely to be considering testing (Odds Ratio=4.31, 95% Confidence Interval=1.28, 14.54, p=.02). Women who had a personal history of cancer (Odds Ratio=4.07, 95% Confidence Interval=1.10, 15.06, p=.04) and women who believed they were at high risk for developing breast cancer were most likely to report greater limitations and risks cancer (Odds Ratio=2.84, 95% Confidence Interval=1.04, 7.74, p=.04). Pros scores were higher among women older than age 50 and those who were unemployed. The results of this study suggest that although African American women at moderate and high risk for BRCA1/2 mutations report favorable attitudes about genetic testing, interest in testing may be limited. Women affected with cancer and those who believe they are at a higher risk for developing breast cancer may be most concerned about the negative consequences of testing. Increased attention may need to be given to beliefs about genetic testing and testing motivations during genetic counseling with African American women. Culturally-tailored genetic counseling may be one strategy for addressing beliefs about genetic testing and facilitating decision-making about genetic testing for BRCA1/2 mutations.

Recruiting African American Women to Participate in Hereditary Breast Cancer Research (Halbert CH, Brewster K, Collier A, Kessler L, Weathers B, Stopfer J, Domchek S, Wileyto P, Submitted to Journal of Clinical Oncology, Manuscript Under Revision). Recommendations for improving African American participation in medical research include targeting community resources and using personalized recruitment strategies; however, limited information is available on the effectiveness of these approaches for recruiting African American women to participate in hereditary breast cancer research. The purpose of this study was to evaluate the yield of eligible women identified from community and clinical sources and to describe rates of enrollment in a genetic counseling study among African American women at increased risk for hereditary breast cancer. Bivariate analyses were conducted to evaluate the association between clinical factors, recruitment variables (e.g., type of referral site), and enrollment decisions. Logistic regression analysis was conducted to identify factors having independent associations

with study enrollment. A total of 788 women referred to the study; of these, 168 (21%) were eligible for participation. Eligible women were most likely to be referred from oncology clinics (44%) compared to community resources (23%) and general practices (11%) (Chi Square=96.80, $p=.0001$). Overall, 62% of eligible women enrolled in the study. Women who had two or more relatives affected with cancer were twice as likely to enroll in the study compared to women who had fewer affected relatives (OR=2.32, 95% CI=1.15, 4.66, $p=.02$). Women recruited from oncology clinics and community resources were also about four times more likely to enroll compared to those recruited through general medical practices (OR=3.88, 95% CI=1.89, 7.98, $p=.002$). These results suggest that African American enrollment in genetic counseling research that focuses on hereditary breast cancer may be motivated by the recruitment setting and familial experiences with cancer.

Career Development Activities. Because this project is linked with Dr. Hughes' career development award, a summary of the professional development activities that were completed during the past year is included in this report. During the past year, Dr. Hughes has continued to be an integral member of the Abramson Cancer Center at the University of Pennsylvania. Her research on cultural factors in genetic counseling for breast cancer susceptibility in African American women has allowed Dr. Hughes to take a leadership role in the recently funded Center for Population Health and Health Disparities at the University of Pennsylvania. Dr. Hughes is Co-PI for the Center, is leader of one project within the Center, and also directs the community outreach and dissemination core. In addition, as a result of the experience gained through developing a risk counseling program for African American women, Dr. Hughes has been able to participate in the recently funded Center of Excellence in Cancer Communications at the University of Pennsylvania. Specifically, Dr. Hughes received funding for a pilot study within the center to develop and evaluate messages for communicating information about genetic risks for smoking among African American men and women. In addition to Dr. Hughes's involvement in these Centers, she has also been invited to deliver presentations at two scientific conferences during the past year.

C. KEY RESEARCH ACCOMPLISHMENTS

During the past year, our efforts have focused on continuing subject recruitment, completing genetic counseling and education, and generating peer-reviewed manuscripts. A summary of these accomplishments is described below.

- Doubled the number of eligible women identified (more than 100 eligible women were identified for participation in the study during the past year; overall, a total of 228 eligible women have been identified through the community-based referral network established for recruitment efforts).
- Doubled the number of women enrolled in the study (84 women enrolled in the study during the past year, bringing the total number of study participants to 141).
- Tripled the number of genetic counseling and education sessions completed (51 pre-test education and counseling sessions were completed during the past year).
- Published 2 peer-reviewed manuscripts during the past year (to date, a total of 6 peer-reviewed papers have been published from data generated with grant support).

D. REPORTABLE OUTCOMES

Manuscripts Published with Grant Support During the Past Year

Halbert CH. Decisions and outcomes of genetic testing for inherited breast cancer risk. *Annals of Oncology*. 2004;15 (Supplement):I35-I39.

Kessler L, Collier A, Brewster K, Smith C, Weathers B, Wileyto EP, Halbert CH. Attitudes about genetic testing and genetic testing intentions in African American women at increased risk for hereditary breast cancer. *Genetics in Medicine*. In press.

Manuscripts Under Review and in Preparation

Halbert CH, Kessler LK, Collier A, Weathers B, Smith C. Recruiting African American Women to Participate in Hereditary Breast Cancer Research. Submitted to the *Journal of Clinical Oncology*, Under Revision.

Halbert CH, Kessler L, Collier A, Weathers B, Brewster K. Psychological Functioning in African American Women at Increased Risk for Hereditary Breast and Ovarian Cancer. *Clinical Genetics*, Under Review.

Weathers B, Brewster K, Collier A, Kessler L, Wileyto EP, Halbert CH. Religious Coping Efforts among African American Women at Increased Risk for BRCA1 and BRCA2 Mutations. Manuscript in Preparation.

Kessler L, Collier A, Brewster K, Weathers B, Wileyto EP, Halbert CH. Congruence between Genetic Testing Intentions and Participation in Genetic Counseling among African American Women. Manuscript in Preparation.

Halbert CH, Kessler L, Collier A, Brewster K, Weathers B. Impact of Culturally-Tailored Genetic Counseling on BRCA1/2 Testing Decisions. Manuscript in Preparation.

Invited Lectures and Presentations Delivered by Dr. Hughes

"Ethnic Differences in Genetic Counseling and Testing Decisions." Genetic and Health Disparities Conference, Institute for Social Research, University of Michigan, Ann Arbor, MI (Invited Lecture)

"Genetics of Breast Cancer: What It Means for Your Family." Ninth Annual Sisters Surviving Breast Cancer Conference, American Cancer Society, Philadelphia, PA (Invited Lecture)

"Factors Associated with Participation in Cancer Genetic Counseling among African American Women." Paper to be presented at the American College of Medical Genetics Annual Conference, Dallas, TX, March 2005. (Paper Presentation)

"Recruiting African American Women to Participate in Hereditary Breast Cancer Research."
Paper to be presented at the Society of Behavioral Medicine Annual Scientific Conference,
Boston, MA, April 2005. (Paper Presentation)

E. CONCLUSIONS AND FUTURE PLANS

During the past year, our activities have focused on continuing subject recruitment, completing genetic counseling and education sessions, and generating peer-reviewed manuscripts. The past year of the study has been productive and we have achieved a number of significant accomplishments. First, we have demonstrated that it is possible to enroll African American women into hereditary breast cancer research. African American women have been under-represented in hereditary breast cancer research; however, we have been able to identify a total of 228 African American women at increased risk for hereditary disease and 62% of the women identified have enrolled in the study. While there is room for improvement in African American enrollment in hereditary breast cancer research, our enrollment rates are similar to the rates reported for Caucasian participation in hereditary breast cancer research (Lerman et al., 1996) and exceeds the enrollment rates reported for African American women in other genetic counseling and testing research protocols (Thompson et al., 2000). Our work during the past year has also shown that African American women at increased risk for hereditary breast cancer report favorable attitudes about the benefits of genetic testing and anticipate few limitations and risks of genetic testing. While this finding is consistent with prior reports (Hughes et al., 1997), the results from our work emphasize the need for increased attention to be given to beliefs about genetic testing and testing motivations during genetic counseling with African American women. Culturally-tailored genetic counseling may be one strategy for addressing beliefs about genetic testing among African American women and facilitating decision-making about testing in this population. During the next year of the project, we will continue to accrue subjects and perform data analysis to address our study aims. These results will be presented at scientific conferences and prepared for publication.

F. REFERENCES

- Hughes C, Caminero AG, Benkendorf J, et al. Ethnic differences in knowledge and attitudes about BRCA1 testing in women at increased risk. *Patient Educ Couns* 1997;32:51-62.
- Lerman C, Narod S, Schulman K, Hughes C, et al. BRCA1 testing in families with hereditary breast-ovarian cancer: A prospective study of patient decision-making and outcomes. *JAMA*. 1996;275:1885-1892.
- Lerman C, Hughes C, Benkendorf JL, et al. Racial differences in testing motivation and psychological distress following pre-test education for BRCA1 gene testing. *Cancer Epidemiol Biomarkers Prev* 1999;8:361-367.
- Thompson HS, Valdimarsdottir HB, Duteau-Buck C, et al. Psychosocial predictors of BRCA counseling and testing decisions among urban African American women. *Cancer Epidemiol Biomarkers Prev* 2002;11:1579-1585.

G. APPENDICES

See attached for manuscripts published and abstracts generated with grant support.

DAMD17-00-1-0262

**GENETIC COUNSELING FOR BREAST CANCER SUSCEPTIBILITY IN AFRICAN
AMERICAN WOMEN**

- Manuscripts published with grant support during the past year
- Abstracts

Original Research

Attitudes about Genetic Testing and Genetic Testing Intentions in African American Women at
Increased Risk for Hereditary Breast Cancer

RUNNING TITLE: Attitudes and Intentions in African Americans

Lisa Kessler, MS, CGC¹ Aliya Collier, BA¹ Kiyona Brewster, MA¹ ChaChira Smith²

Benita Weathers, MPH¹ E. Paul Wileyto, Ph.D.¹ Chanita Hughes Halbert, Ph.D.³

¹Department of Psychiatry, University of Pennsylvania, Philadelphia, PA

²Abramson Cancer Center, University of Pennsylvania, Philadelphia, PA

³Department of Psychiatry and Abramson Cancer Center, University of Pennsylvania, Philadelphia, PA

CORRESPONDING AUTHOR: Chanita Hughes Halbert, Ph.D., University of Pennsylvania,
3535 Market Street, Suite 4100, Philadelphia, PA 19104, Telephone (215) 746-7140, Facsimile
(215) 746-7140, Electronic Mail chanita@mail.med.upenn.edu

Supported by Department of Defense Grant #DAMD17-00-1-0262.

ABSTRACT

Purpose: To evaluate attitudes about the benefits, limitations, and risks of genetic testing for *BRCA1* and *BRCA2* (*BRCA1/2*) mutations and explore testing intentions in African American women at increased risk for hereditary breast cancer.

Methods: Attitudes and intentions were evaluated by telephone in African American women (n=74) at moderate and high risk for having a *BRCA1/2* mutation.

Results: Attitudes about the benefits of genetic testing were endorsed at higher rate relative to limitations and risks; however, only 30% of respondents indicated that they would definitely have testing. In regression analysis, women most likely to be considering testing were those with fatalistic beliefs about cancer and those who believed they had a *BRCA1/2* mutation.

Women who had two or more affected relatives were also most likely to be considering testing.

Women who had a personal history of cancer and those who believed they were at high risk for developing breast cancer were most likely to report greater limitations and risks. Pros scores were higher among women older than age 50 and those who were unemployed.

Conclusion: Although African American women at moderate and high risk for *BRCA1/2* mutations report favorable attitudes about genetic testing, interest in testing may be limited.

Women affected with cancer and those who believe they are at a higher risk for developing breast cancer may be most concerned about the negative consequences of testing. Increased attention may need to be given to beliefs about genetic testing and testing motivations during genetic counseling with African American women.

KEY WORDS: African American, attitudes, genetic testing

INTRODUCTION

Genetic counseling and testing for *BRCA1* and *BRCA2* (*BRCA1/2*) mutations are now available to individuals at increased risk for having a gene mutation. If found to carry a risk-conferring mutation, women have a 60% to 80% lifetime risk of developing breast cancer and a 10% to 45% lifetime risk of developing ovarian cancer.¹⁻⁴ In addition to providing cancer risk information to individuals who are tested, *BRCA1/2* genetic test results also have implications for family members. *BRCA1/2* mutations are transmitted through autosomal dominant inheritance and first-degree relatives (FDRs) of mutation carriers have a 50% chance of having the *BRCA1/2* mutation identified in a family member. Recent epidemiological studies have shown that the prevalence of *BRCA1/2* mutations ranges between 16% and 21% in African American women with a personal and family history of breast and/or ovarian cancer;⁵⁻⁷ efforts are being made to increase access to genetic counseling and testing among African American women. However, limited empirical data are available on attitudes about genetic testing or interest in genetic testing for *BRCA1/2* mutations in African American women at increased risk for hereditary breast cancer.

Previous studies have examined attitudes about genetic testing and testing intentions in African American women at low risk for having a *BRCA1/2* mutation⁸⁻¹⁰ (e.g., unaffected African American women without a personal or family history of breast and/or ovarian cancer) and in unaffected women with one first-degree relative diagnosed with breast and/or ovarian cancer.¹¹⁻¹³ Attitudes about genetic testing and intentions were evaluated in a recent study that included African Americans at high risk for having a *BRCA1* mutation; more than 80% of participants in this study indicated that they would definitely have genetic testing.¹⁴ However, the results from this study have limited generalizability because participants were from a single

family identified from a hereditary breast cancer registry. Empirical data on attitudes about genetic testing and testing intentions are needed among more generalizable samples of African American women at increased risk for having a *BRCA1/2* mutation.

The purpose of the present study was to evaluate attitudes about the benefits, limitations and risks of genetic testing for *BRCA1/2* mutations and to explore genetic testing intentions among African American women at increased risk for hereditary breast cancer. While previous studies have compared African American and Caucasian women in terms of attitudes and intentions,^{9,11} we were interested in exploring these variables specifically in African American women. Ethnic group comparisons in attitudes about genetic testing and genetic testing intentions have been critical to characterizing differences in beliefs about genetic testing and interest in utilizing this service between African American and Caucasian women; however, a better understanding of within group variation in attitudes and interest among African American women is needed to develop more effective genetic counseling protocols for this population. Therefore, a second objective of this study was to identify factors having independent associations with attitudes about genetic testing and testing intentions specifically in African American women at increased risk for hereditary disease. Because previous research has shown that fatalism is negatively associated with genetic testing intentions among African American men,¹⁵ we were particularly interested in evaluating the association between fatalistic beliefs about cancer and intentions to have genetic testing for inherited breast cancer risk among African American women.

MATERIALS AND METHODS

Study Population

This study was conducted at the University of Pennsylvania following approval from the Institutional Review Board. Participants were African American women at increased risk for having a *BRCA1/2* mutation (n=74). To be eligible, women had to have a 5%-10% prior probability of having a *BRCA1/2* mutation based on their personal and family history of breast and/or ovarian cancer. A 5% to 10% prior probability of having a *BRCA1/2* mutation is considered to be the lower bound for clinical genetic testing.¹⁶ To determine eligibility, probability of having a *BRCA1/2* mutation was estimated based on the individual's personal and family history of breast and/or ovarian cancer using risk estimation models from previous research.¹⁶⁻¹⁹ We also used mutation prevalence tables to estimate empiric risk of having a *BRCA1/2* mutation.⁶ All women completed a baseline telephone interview as part of their participation in a randomized trial comparing alternate models of genetic counseling. Sixty-one percent of eligible women contacted completed the baseline telephone interview.

Procedures

Subjects were recruited to participate in the study through referrals from physicians and clinic staff at the University of Pennsylvania Health System and community hospitals and health clinics located in Philadelphia, PA or through self-referrals. Subjects recruited through physicians and staff were told about the study during a clinic visit. Women were also recruited into the study by clinic staff at health fairs and African American breast cancer support groups. Specifically, written information about the study was given to women at health fairs following a description of the project and presentations about the study were given at breast cancer support

groups. Women could also self-refer to the study by responding to newspaper advertisements. Women who were interested in participating in the study contacted research staff directly or completed a referral form. Following referral, eligible women were mailed an introductory letter. The introductory letter described the purpose of the study and the procedures involved in participating. A reply card was included with the introductory letter for women to return indicating their interest in participating in the study. Women who did not decline participation were contacted for the baseline telephone interview about two weeks after the introductory letter was mailed. It should be noted that some women ($n=11$) had provided a blood sample as part of a separate study to understand genetic risk factors for breast cancer in African American women before their participation in this study. However, clinical genetic testing for *BRCA1/2* mutations was not performed on these blood samples and none of these individuals received genetic test results prior to the current study. Provision of a blood sample was controlled for in the statistical analysis.

The baseline telephone interview was a structured survey that took approximately 40-minutes to complete. This interview was administered by a research assistant at Penn and assessed sociodemographics, personal and family history of breast and ovarian cancer, fatalistic beliefs about cancer, perceived risk and control variables, attitudes about genetic testing, and genetic testing intentions. Following the interview, consenting subjects were randomized to one of two genetic counseling protocols. The present paper focuses on data collected during the baseline telephone interview prior to genetic counseling.

Measures

Predictor Variables

Sociodemographic characteristics. Age, income level, marital status, education level, and employment status were obtained during the baseline telephone interview.

Clinical factors. The number of relatives diagnosed with breast and ovarian cancer was obtained during the baseline telephone interview. Risk of having a *BRCA1/2* mutation (moderate or high) was estimated based on women's personal and family history of cancer using risk estimation models and empiric risk data from previous research.^{6,16-19}

Beliefs about cancer. Fatalistic beliefs about cancer were measured using items from the Powe Fatalism Inventory (PFI).²⁰ The PFI is a 15-item instrument that measures fatalistic beliefs about cancer; however, because previous research has shown that all items load on one factor and the instrument has high internal consistency (Cronbach's $\alpha=.84$)²⁰ we used two items from the PFI in this study. Because genetic testing provides information about future disease risks and may generate fear about cancer, we selected items that represented fatalistic beliefs about disease risks and fatalistic beliefs about getting checked for cancer. Specifically, respondents were asked if they believed that getting checked for cancer makes people scared that they may really have cancer (true or false) and if someone is meant to have cancer, they will have cancer (true or false).

Perceptions of Risk and Control. We used two Likert-style items to evaluate perceived risk and control over developing breast cancer. Specifically, respondents were asked what their chances of getting breast cancer were compared to other women their age (1=much lower, 2=a

little lower, 3=about the same, 4=a little higher, 5=much higher) and how much control they had over whether they develop breast cancer (1=none at all, 2=a little, 3=a moderate amount, 4=a lot). Respondents who had a personal history of breast and/or ovarian cancer were asked to indicate their perceived risk of developing breast cancer again and their perceived control over developing this disease again. These items were adapted from items used and validated in prior reports among women at increased risk for developing breast cancer^{21,22} and women with a personal history of breast cancer.^{23,24} These items have also been used in previous research with African American women²⁵ and in research on education and counseling about hereditary breast cancer.²⁶ Respondents were also asked to indicate how likely it was that they had a *BRCA1/2* mutation using a Likert style item (1=not at all likely, 2=somewhat likely, 3=very likely, 4=definitely). This item has been validated in previous research on interest in genetic testing among Caucasian women²⁷ and has been used in prior studies on education and counseling about hereditary breast cancer and genetic testing among African American and Caucasian women.²⁸

Outcome Variables

Attitudes about Genetic Testing. Attitudes about genetic testing were evaluated using a 14-item Likert-style questionnaire that assessed the potential benefits, limitations, and risks of genetic testing for inherited breast cancer risk. The questionnaire consisted of two factors: perceptions of the benefits of genetic testing (pros) and perceptions of the limitations and risks of genetic testing (cons). Specifically, pros items measured the importance of obtaining cancer risk information and information that would facilitate decisions about health care (e.g., reduce uncertainty, to know if cancer screening tests are needed more often) while cons items measured the importance the emotional, familial, and ethical impact of genetic testing (e.g., concern about

the impact of testing on family members, unable to handle the emotional impact of testing).

Respondents were asked to rate the importance of each reason in their decision to be tested for inherited breast cancer susceptibility. This instrument has been validated in previous research on attitudes about genetic testing in African American women who have a family history of breast and/or ovarian cancer.¹¹ Both the pros and cons scales had good internal consistency in this sample (Cronbach's alpha = .86 for pros and .70 for cons). Scores for both pros and cons ranged between 7-21.

Genetic testing intentions. A Likert-style item was used to evaluate genetic testing intentions. Specifically, respondents were asked if they were (1) not considering or have not thought about having genetic testing for breast-ovarian risk, (2) considering genetic testing, (3) probably will have genetic testing, or (4) definitely will have genetic testing. This item had acceptable face validity and has been used to measure the outcome of providing education about hereditary breast cancer and genetic testing to African American women.^{28,29}

Data Analysis

First, frequencies were generated to characterize respondents in terms of sociodemographic characteristics and clinical factors. Frequencies were also generated to characterize responses to items measuring attitudes about genetic testing. In addition, descriptive statistics were generated to describe mean levels of pros and cons and to characterize interest in genetic testing. Next, we conducted bivariate analyses to evaluate the association between predictor variables and pros, cons, and testing intentions. Because pros and cons scores were not normally distributed, we used nonparametric analysis of variance with the Kruskal-Wallis chi

square statistic to evaluate the association between pros and cons and sociodemographics, clinical factors, fatalistic beliefs about cancer, and perceived risk and control variables. Next, we used chi square tests of association to evaluate the relationship between predictor variables and genetic testing intentions. We also used non-parametric analysis of variance to evaluate the association between genetic testing intentions and pros and cons. Testing intentions were re-coded into a dichotomous variable (considering versus not considering) for these analyses. To identify factors having independent associations with genetic testing intentions, we conducted backward stepwise logistic regression analysis. We used this same strategy to identify factors having independent associations with attitudes about genetic testing after re-coding these variables into dichotomous variables. We used the median split to re-code attitudes about genetic testing into dichotomous variables. The median value for cons was 9; respondents who scored at or below 9 were categorized as perceiving few limitations and risks and those who scored above 9 were categorized as perceiving greater limitations and risks. This same procedure was used to dichotomize continuous scores for attitudes about the benefits of genetic testing (median value = 20). All variables with significant bivariate associations with attitudes and intentions ($p < .10$) were included in the initial model for each variable after controlling for prior provision of a blood sample.

RESULTS

Sample Characteristics

As shown in Table 1, most respondents were ages 50 and younger (54%), were not married (61%), had some college education (72%), were employed (68%), and had an annual household income of \$35,000 or more (53%). In terms of clinical factors, most respondents had

a personal history of breast and/or ovarian cancer (76%), had two or more relatives affected with breast and/or ovarian cancer (57%), and were at high risk for having a *BRCA1/2* mutation (50%).

Descriptive Information on Attitudes about Genetic Testing

Overall, the benefits of genetic testing were endorsed at a higher rate than the limitations and risks of genetic testing. The mean pros score was 18.69 (S.D.=3.3) whereas the mean cons score was 10.05 (S.D.=3.0). As shown in Figure 1, the most important benefit of genetic testing was to know if additional steps are needed to prevent cancer. The least important benefit of genetic testing was to make childbearing decisions; however, more than half (65%) of respondents indicated that this would be a very important benefit of genetic testing. The proportion of respondents rating the limitations and risks of genetic testing is provided in Figure 2. The most important limitation or risk of genetic testing was concern about the impact of testing on family members (25% rated very important) while the least important limitation or risk was the belief that cancer could not be prevented (5% rated very important).

Bivariate Analysis of Attitudes about Genetic Testing

As shown in Table 2, only age and employment status were associated significantly with pros. Pros scores were significantly higher among women who were older than age 50 and among those who were not employed compared to women who were ages 50 and younger and those who were employed. Fatalistic beliefs about cancer, perceived risk and control over developing breast cancer, and perceived risk of having a *BRCA1/2* mutation were not associated significantly with pros. However, these factors were marginally associated with cons. Women who believed that they had a higher or much higher risk for developing breast cancer reported

greater cons compared to women who believed that they had the same or lower risk. However, cons were higher among women who believed that they had a moderate or a lot of control over whether they develop breast cancer compared to those who believed they had no or a little control. Beliefs about cancer screening, marital status, education level, *BRCA1/2* risk level, and family history of breast and ovarian cancer, and prior provision of a blood sample were not associated significantly with pros or cons.

Descriptive Information on Genetic Testing Intentions

Consistent with the favorable attitudes about the benefits of genetic testing, most respondents reported that they were contemplating having testing for inherited breast cancer risk. However, only 30% reported that they would definitely have genetic testing, 22% indicated that they would probably have genetic testing, and 16% were considering having genetic testing. Thirty-two percent of respondents reported that they were not considering or had not thought about having genetic testing.

Bivariate Analysis of Genetic Testing Intentions

The results of the bivariate analysis of genetic testing intentions are provided in Table 3. Of the sociodemographic characteristics, only age was associated significantly with genetic testing intentions. Women who were ages 50 and younger were significantly more likely to be considering genetic testing compared to women over age 50. While cancer history was not associated significantly with genetic testing intentions, women who had two or more relatives affected with breast and/or ovarian cancer and those at high risk for having a *BRCA1/2* mutation were significantly more likely to be considering genetic testing compared to women who had a

fewer number of affected relatives and women at moderate risk. Fatalistic beliefs about cancer and perceived risk of having a *BRCA1/2* mutation were also associated significantly with genetic testing intentions. Seventy-six percent of women who believed that getting checked for cancer generates fear were considering genetic testing compared to 54% of women who did not endorse this belief (Chi Square=4.02, $p=.04$). In addition, women who believed that they had a *BRCA1/2* mutation were significantly more likely to be considering genetic testing compared to women who did not believe that they had a mutation. Pros (Kruskal-Wallis Chi Square=2.20, $p=.14$) and cons (Kruskal-Wallis Chi Square=1.90, $p=.17$) were not associated significantly with genetic testing intentions. Perceived risk and control over developing breast cancer and prior provision of a blood sample were also not associated significantly with genetic testing intentions.

Multivariate Model of Intentions and Attitudes about Genetic Testing

The results of the regression analyses are provided in Table 4. Because only two factors were associated significantly with pros in bivariate analyses, we did not generate a multivariate regression model for this variable. In the model for cons, perceived control over developing breast cancer was removed on the first step (Chi square change (1_{df}, $n = 74$) = 2.03, $p = .15$). None of the remaining variables could be removed from the model; thus, the final model for cons included cancer history and perceived risk of developing breast cancer. Women affected with cancer were about four times more likely than unaffected women to report greater cons. Women who believed that they were at higher or much higher risk for developing breast cancer were also significantly more likely to report greater cons compared to women who believed they were at the same or lower risk for developing breast cancer.

In the model of genetic testing intentions, age was removed on step one (Chi square change (1_{df}, n = 74) = 1.19, p = .28) and *BRCA1/2* risk level was removed on step two (Chi square change (1_{df}, n = 74), = 2.21, p = .15). None of the remaining variables could be removed from the model; thus, the final model for genetic testing intentions included fatalistic beliefs about cancer, perceived risk of having a *BRCA1/2* mutation, and the number of relatives affected with breast and/or ovarian cancer. As shown in Table 4, women who believed that cancer screening generates fear were about five times more likely than women who did not endorse this belief to be considering genetic testing. However, women who believed that they had a *BRCA1/2* mutation were significantly more likely to be considering genetic testing compared to those who did not believe that they have a mutation. Compared to women with fewer affected relatives, those who had two or more relatives affected with breast and/or ovarian cancer were about four times more likely to be considering genetic testing.

DISCUSSION

Although ethnic differences in attitudes about genetic testing and genetic testing intentions have been evaluated in a number of previous studies,^{8,9,11,13,29} limited empirical data are available on attitudes and intentions specifically among African American women at increased risk for hereditary breast cancer. This study evaluated attitudes about the benefits, limitations, and risks of genetic testing and explored intentions to have testing for inherited breast cancer susceptibility in African American women at moderate and high risk for having a *BRCA1/2* mutation. Consistent with prior reports,^{9,11} respondents in the present study reported positive attitudes about genetic testing. Relative to the limitations and risks of genetic testing, the benefits of genetic testing were endorsed at a higher rate by respondents in the present study.

Similar to other studies,¹¹ the most important benefit of genetic testing was to learn if additional steps are needed to prevent cancer while the least important benefit was to make childbearing decisions. While concern about the impact of testing on family members was the most important limitation or risk of genetic testing in this study and in prior reports,^{11,30} distrust of the medical community was the least important limitation or risk in the present study. While it is standard practice to identify family members at risk for having a *BRCA1/2* mutation during test results disclosure, this finding suggests that concerns about the impact of testing on family members may need to be addressed during pre-test genetic counseling and test results disclosure with African American women.

We found that cancer history and perceived risk of developing cancer were associated significantly with cons. Women affected with breast and/or ovarian cancer and those who believed that they were at higher or much higher risk for developing breast cancer were significantly more likely to report greater cons compared to unaffected women and those who did not believe they were at higher risk for developing breast cancer. However, perceived risk of developing breast cancer was not associated with cons in a prior report.⁹ It is possible that different results were obtained in the present study because participants were at moderate and high risk for having a *BRCA1/2* mutation whereas participants in the study conducted by Donovan and Tucker were not at increased risk for hereditary disease. Another possible explanation is that perceived risk of developing breast cancer was confounded with ethnicity in prior reports. African American women were significantly less likely than Caucasian women to believe that they were at increased risk for developing breast cancer in the study conducted by Donovan and Tucker.⁹ The present study only included African American women and about half reported that they were at higher or much higher risk for developing breast cancer. These

findings underscore the importance of evaluating attitudes about genetic testing within specific ethnic groups to minimize the influence of confounding when making ethnic group comparisons.

Although endorsement of the benefits of genetic testing was high in this study, only 30% of respondents indicated that they would definitely have genetic testing. Previous research has shown that more than 80% of African Americans at high-risk for having a *BRCA1/2* mutation reported that they would have genetic testing;¹⁴ however, only 68% of respondents in the present study reported that they were considering genetic testing. This difference may be due to variations in sample characteristics between the present study and the research by Kinney et al. The present study included African American women at moderate and high risk for having a *BRCA1/2* mutation who were not selected for membership in a family whereas the study conducted by Kinney and colleagues included African Americans from a single family in which a *BRCA1* mutation had been previously identified. Some members of this family had provided a blood sample to isolate *BRCA1*;¹⁴ thus, these individuals may have been more interested in obtaining their *BRCA1* test result. It is also possible that interest was lower in the present study because the sample included women at moderate risk for having a *BRCA1/2* mutation. However, *BRCA1/2* risk level did not have a significant effect on testing intentions in regression analysis. The number of relatives affected with breast and/or ovarian cancer and perceived risk of having a *BRCA1/2* gene alteration were associated significantly with testing intentions in the regression model. Women with a greater number of affected relatives and those who believed that they had a *BRCA1/2* mutation were significantly more likely to be considering genetic testing compared to women with fewer affected relatives and those who did not believe they had a *BRCA1/2* mutation. Similar results were obtained in the study conducted by Kinney et al.; thus, perceived

risk of having a *BRCA1/2* mutation and family history of cancer may be most important to genetic testing intentions among African American women.

Surprisingly, women who reported fatalistic beliefs about cancer were significantly more likely to be considering genetic testing compared to women who had less fatalistic beliefs. Specifically, women who believed that screening for cancer generates fear were about five times more likely than those who did not endorse this belief to be considering genetic testing. This finding differs from previous research in which cancer fatalism was associated with less interest in genetic testing for inherited prostate cancer risk.¹⁵ However, a recent study has shown that cancer fatalism is higher among African American women who participate in genetic counseling and receive *BRCA1/2* test results compared to those who decline genetic counseling and testing.³¹ Cancer fatalism is a multi-dimensional construct that includes elements of powerlessness, fear, pessimism, and predetermination.³² It is possible that women who had a more fatalistic outlook are interested in genetic testing for inherited breast cancer risk as a way to overcome fear about cancer. Another possible explanation is that women with fatalistic beliefs are more interested in genetic testing because they think that they are predetermined to have *BRCA1/2* mutation; interest in testing may be motivated by a desire to confirm this belief. It is important to note that we only used two items to evaluate fatalism and additional research is needed to evaluate the effects of cancer fatalism on utilization of genetic testing in larger samples of African American women at increased risk for hereditary breast cancer.

In considering the results of the present study, several limitations should be noted. First, only 61% of eligible women completed the baseline telephone interview and the sample included 74 African American women. Although a recent review on minority recruitment demonstrated that the challenges associated with recruiting African American women to participate in medical

research may be more extensive in genetic counseling and testing studies,³³ our participation rates were similar to those reported in other cancer research designed to understand psychosocial issues among African American women.^{34,35} An additional limitation is that we had approximately 70% power to detect small to moderate differences in genetic testing intentions between respondents with different beliefs about cancer, family history of disease, and perceived risk of having a *BRCA1/2* mutation. Further, because of the small sample size, the power to detect differences in perceptions of the limitations and risks based on personal history of disease and perceived risk of developing breast cancer was also limited. We also used single, self-report items to measure beliefs about cancer and perceptions of risk and control. Thus, additional studies are needed to understand attitudes and testing intentions in larger samples of African American women at increased risk for hereditary breast cancer using more extensive measures of beliefs about cancer and risk and control perceptions. Another potential limitation is that some women had donated a blood sample for genetics research prior to their participation in the present study. However, clinical genetic testing for *BRCA1/2* mutations was not performed on these samples and these women had not received genetic test results prior to the present study. Provision of a prior blood sample was not associated with attitudes or intentions and we controlled for this variable in the regression analyses. Finally, we evaluated intentions to have genetic testing rather than actual genetic test acceptance. Prior reports have shown that testing intentions do not translate into similar rates of test acceptance.^{36,37} However, intentions to have genetic testing have not been explored extensively among African American women at increased risk for hereditary breast cancer; thus, the present study provides novel empirical data on interest in genetic testing among an understudied population. Additional research is needed to determine

whether interest in genetic testing corresponds to similar rates of genetic test acceptance in African American women at increased risk for having a *BRCA1/2* mutation.

Despite these potential limitations, the present study demonstrates that among African American women at increased risk for hereditary breast cancer, attitudes about the limitations and risks of genetic testing may be driven by personal experiences with breast and/or ovarian cancer and perceived risk of developing breast cancer while genetic testing intentions are influenced by beliefs about cancer, family history of disease, and perceived risk of having a *BRCA1/2* mutation. These findings suggest that in addition to providing information about one's personal risk of carrying a risk-conferring *BRCA1/2* mutation, greater emphasis may need to be given to the familial implications of genetic risk information in genetic counseling and testing programs targeted to African American women. Increased attention may also need to be given to beliefs about genetic testing and motivations for having genetic testing.

ACKNOWLEDGEMENTS

This research was supported by Department of Defense grant #DAMD17-00-1-0262. We are very grateful to all of the women who participated in this study and would like to acknowledge Wilma Higginbotham for assistance with manuscript preparation.

REFERENCES

- [1] Antoniou A, Pharoah PD, Narod S, Risch HA, Eyfjorð JE, Hopper JL, Loman N, Olsson H, Johannsson O, Borg A, Pasini B, Radice P, Manoukian S, Eccles DM, Tang N, Olah E, Anton-Culver H, Warner E, Luninski J, Gronwald J, Gorski B, Tulinius H, Thorlacius S, Eerola H, Nevanlinna H, Syrjäkoski K, Kallioniemi OP, Thompson D, Evans C, Peto J, Lalloo F, Evans DG, Easton DF. Average risks of breast and ovarian cancer associated with *BRCA1* or *BRCA2* mutations detected in case series unselected for family history: a combined analysis of 22 studies. *Am J Hum Genet* 2003;72:1117-1130.
- [2] Struwing JP, Hartge P, Wacholder S, Baker SM, Berlin M, McAdams M, Timmerman MM, Brody LC, Tucker MA. The risk of cancer associated with specific mutations of *BRCA1* and *BRCA2* among Ashkenazi Jews. *N Engl J Med* 1997;336:1401-1408.
- [3] Easton DF, Ford D, Bishop DT. Breast and ovarian cancer incidence in *BRCA1*-mutation carriers. *Am J Hum Genet* 1995;56:265-271.
- [4] Ford D, Easton DF, Stratton M, Narod S, Goldgar D, Devilee P, Bishop DT, Weber B, Lenoir G, Chang-Claude J, Sobol H, Teare MD, Struwing J, Arason A, Scherneck S, Peto J, Rebbeck TR, Tonin P, Neuhausen S, Barkardottir R, Eyfjorð J, Lynch H, Ponder BA, Gayther SA, Zelada-Hedman M, The Breast Cancer Linkage Consortium. Genetic heterogeneity and penetrance analysis of the *BRCA1* and *BRCA2* genes in breast cancer families. *Am J Hum Genet* 1998;62:676-689.

- [5] Panguluri RC, Brody LC, Modali R, Utley K, Campbell LA, Day AA, Whitfield, BC, Dunston GM. *BRCA1* mutations in African Americans. *Hum Genet* 1999;105:28-31.
- [6] Frank TS, Deffenbaugh AM, Reid JE, Hulick M, Ward BE, Lingenfelter B, Gumper KL, Scholl T, Tavtigian SV, Pruss DR, Critchfield GC. Clinical characteristics of individuals with germline mutations in *BRCA1* and *BRCA2*: analysis of 10,000 individuals. *J Clin Oncol* 2002;20:1480-1490.
- [7] Gao Q, Tomlinson G, Das S, Cummings S, Sveen L, Fackenthal J, Schumm P, Olopade OI. Prevalence of *BRCA1* and *BRCA2* mutations among clinic-based African American families with breast cancer. *Hum Genet* 2000;107:186-191.
- [8] Peters N, Rose A, Armstrong K. The association between race and attitudes about predictive genetic testing. *Cancer Epidemiol Biomarkers Prev* 2004;13:361-365.
- [9] Donovan KA, Tucker DC. Knowledge about genetic risk for breast cancer and perceptions of genetic testing in a sociodemographically diverse sample. *J Behav Med* 2000;23:15-36.
- [10] Gwyn K, Vernon SW, Conoley PM. Intention to pursue genetic testing for breast cancer among women due for screening mammography. *Cancer Epidemiol Biomarkers Prev* 2003;12:96-102.

[11] Hughes C, Caminero AG, Benkendorf J, Kerner J, Isaacs C, Barter J, Lerman C. Ethnic differences in knowledge and attitudes about *BRCA1* testing in women at increased risk. *Patient Educ Couns* 1997;32:51-62.

[12] Lipkus IM, Iden D, Terrenoire J, Feaganes JR. Relationships among breast cancer concern, risk perceptions, and interest in genetic testing for breast cancer susceptibility among African American women with and without a family history of breast cancer. *Cancer Epidemiol Biomarkers Prev* 1999;8:533-539.

[13] Durfy SJ, Bowen DJ, McTiernan A, Sporleder J, Burke W. Attitudes and interest in genetic testing for breast and ovarian cancer susceptibility in diverse groups of women in western Washington. *Cancer Epidemiol Biomarkers Prev* 1999;8:369-375.

[14] Kinney AY, Croyle RT, Dudley WN, Bailey CA, Pelias MK, Neuhausen SL. Knowledge, attitudes, and interest in breast-ovarian cancer gene testing: a survey of a large African American kindred with a *BRCA1* mutation. *Prev Med* 2001;33, 543-551.

[15] Myers RE, Hyslop T, Dozier KJ, Wolf TA, Burgh DY, Diehl JA, Lerman C, Chodak GW. Intention to be tested for prostate cancer risk among African American men. *Cancer Epidemiol Biomarkers Prev* 2000;9:1323-1328.

- [16] Domchek SM, Eisen A, Calzone K, Stopfer J, Blackwood A, Weber BL. Application of breast cancer risk prediction models in clinical practice. *J Clin Oncol* 2003;21:593-601.
- [17] Parmigiani G, Berry D, Aguillar O. Determining carrier probabilities for breast cancer-susceptibility genes *BRCA1* and *BRCA2*. *Am J Genet* 1998;62:145-158.
- [18] Couch FJ, DeShano ML, Blackwood MA, Calzone K, Stopfer J, Campeau L, Ganguly A, Rebbeck T, Weber BL. *BRCA1* mutations in women attending clinics that evaluate the risk of breast cancer. *N Engl J Med* 1997;336:1409-1415.
- [19] Blackwood MA, Yang H, Margolin A. Predicted probability of breast cancer susceptibility gene mutations. *Breast Cancer Res Treat* 2001;69:223.
- [20] Powe BD. Cancer fatalism among elderly Caucasians and African Americans. *Oncol Nurs Forum* 1995;22:1355-1359.
- [21] Lerman C, Daly M, Sands C, Balshem A, Lustbader E, Heggan T, Goldstein L, James J, Engstrom P. Mammography adherence and psychological distress among women at risk for breast cancer. *J Natl Cancer Inst* 1993;85:1074-1080.
- [22] Lerman C, Kash K, Stefanek M. Younger women at increased risk for breast cancer: perceived risk, psychological well-being, and surveillance behavior. *J Natl Cancer Inst Monogr* 1994;16:171-176.

- [23] Hilton BA. The relationship of uncertainty, control, commitment, and threat of recurrence to coping strategies used by women diagnosed with breast cancer. *J Behav Med* 1989;12:39-54.
- [24] Taylor SE, Lichtman RR, Wood JV. Attributions, beliefs about control, and adjustment to breast cancer. *J Pers Soc Psychol* 1984;43:489-502.
- [25] Hughes C, Lerman C, Lustbader E. Ethnic differences in risk perception among women at increased risk for breast cancer. *Breast Cancer Res Treat* 1996;40:23-35.
- [26] Audrain J, Schwartz MD, Lerman C, Hughes C, Peshkin BN, Biesecker B. Psychological distress in women seeking genetic counseling for breast-ovarian cancer risk: the contributions of personality and appraisal. *Ann Behav Med* 1997;19:370-377.
- [27] Lerman C, Daly M, Masny A, Balshem A. Attitudes about genetic testing for breast-ovarian cancer susceptibility. *J Clin Oncol* 1994;12:843-850.
- [28] Lerman C, Biesecker B, Benkendorf JL, Kerner J, Gomez-Caminero A, Hughes C, Reed MM. Controlled trial of pretest education approaches to enhance informed decision-making for *BRCA1* gene testing. *J Natl Cancer Inst* 1997;89:148-157.

- [29] Lerman C, Hughes C, Benkendorf JL, Biesecker B, Kerner J, Willison J, Eads N, Hadley D, Lynch J. Racial differences in testing motivation and psychological distress following pretest education for *BRCA1* gene testing. *Cancer Epidemiol Biomarkers Prev* 1999;8:361-367.
- [30] Thompson HS, Valdimarsdottir HB, Duteau-Buck C, Guevarra J, Bovbjerg DH, Richmond-Avellaneda C, Amarel D, Godfrey D, Brown K, Offit K. Psychosocial predictors of *BRCA* counseling and testing decisions among urban African American women. *Cancer Epidemiol Biomarkers Prev* 2002;11:579-585.
- [31] Hughes C, Fasaye GA, LaSalle VH, Finch C. Sociocultural influences on participation in genetic risk assessment and testing among African American women. *Patient Educ Couns* 2003; 51:107-114.
- [32] Powe BD, Finnie R. Cancer fatalism: the state of the science. *Cancer Nurs* 2003;26:454-465.
- [33] Hughes C, Peterson SK, Ramirez A, Gallion KJ, McDonald PG, Skinner CS, Bowen D. Minority recruitment in hereditary breast cancer research. *Cancer Epidemiol Biomarkers Prev* 2004; 13:1146-1155.
- [34] Taylor KL, Siegel JE, Klimi KM, Lamdan RM, Shelby R, Hrywna M. Psychological adjustment among African American breast cancer patients: one-year follow-up results of a randomized psychoeducational group intervention. *Health Psychol* 2003;22:316-323.

- [35] Giwa KA, Ganz PA, Peterson L. Quality of life of African American and white long term breast carcinoma survivors. *Cancer* 1999;85:418-426.
- [36] Lerman C, Seay J, Bakshem A, Audrain J. Interest in genetic testing among first-degree relatives of breast cancer patients. *Am J Med Genet* 1995;57:385-392.
- [37] Lerman C, Narod S, Schulman K, Hughes C, Caminero AG, Boney G, Gold K, Trock B, Main D, Lynch J, Fulmore C, Snyder C, Lemon SJ, Conway T, Tonin P, Lenoir G, Lynch H. BRCA1 testing in families with hereditary breast-ovarian cancer. A prospective study of patient decision making and outcomes. *JAMA* 1996;275:1885-1892.

Table 1. Sample Characteristics (n=74)

Variable	Level	n (%)
Age	<= 50	40 (54%)
	> 50	34 (46%)
Marital status	Not married	45 (61%)
	Married	29 (39%)
Education level	> Some college	53 (72%)
	<= High school	21 (28%)
Employment status	Employed	50 (68%)
	Not employed	24 (32%)
Income level§	> \$35,000	39 (53%)
	<= \$35,000	34 (47%)
Cancer history	Affected	56 (76%)
	Unaffected	18 (24%)
Family history of cancer	Two or more relatives	42 (57%)
	Less than two relatives	32 (43%)
BRCA1/2 risk level	High	37 (50%)
	Moderate	37 (50%)

§one respondent was missing data for income.

Table 2. Association between Attitudes about Genetic Testing and Sociodemographic Characteristics, Clinical Factors, and Perceived Risk and Control (n=74)

Variable	Level	Pros Mean (SD)	Nonparametric Comparison [‡]	Cons Mean (SD)	Nonparametric Comparison [‡]
Sociodemographics and Clinical Factors					
Prior blood sample	Yes	18.82	0.51	9.36	0.27
	No	18.67		10.18	
Age	<= 50	18.02 (3.5)	7.85**	9.90 (2.8)	0.09
	> 50	19.47 (2.7)		10.24 (3.3)	
Marital status	Married	18.10 (3.6)	1.17	10.07 (2.7)	0.05
	Not married	19.07 (3.0)		10.04 (3.1)	
Education level	> Some college	18.58 (3.1)	1.19	9.72 (2.4)	0.21
	<= High school	18.95 (3.6)		10.90 (4.2)	
Employment status	Employed	18.38 (3.0)	6.23**	9.62 (2.6)	1.73
	Not employed	19.33 (3.7)		10.96 (3.6)	
Income level	> \$35,000	18.13 (3.7)	1.39	9.92 (2.9)	0.02
	<= \$35,000	19.26 (2.6)		10.06 (3.1)	
Cancer history	Affected	18.71 (3.4)	0.32	10.45 (3.2)	3.91*
	Unaffected	18.61 (2.9)		8.83 (2.1)	
Family history of cancer	2 or more	18.64 (3.1)	0.90	9.71 (2.8)	0.86
	Less than 2	18.75 (3.5)		10.50 (3.3)	
BRCA1/2 risk level	High	19.05 (3.3)	1.29	10.19 (3.0)	0.13
	Moderate	18.32 (3.2)		9.92 (3.1)	
Beliefs about Cancer					
Screening creates fear	True	19.15 (2.9)	1.71	10.37 (3.1)	1.41
	False	17.90 (3.6)		9.76 (3.0)	
Cancer cannot be prevented	True	18.57 (3.6)	0.0008	10.23 (2.7)	0.75
	False	18.77 (3.0)		9.93 (3.2)	
Perceived Risk and Control					
Perceived breast cancer risk	Higher	18.39 (3.9)	.007	10.76 (3.4)	2.63†
	Lower/same	18.88 (2.6)		9.45 (2.6)	
Perceived control	None/a little	18.92 (3.2)	0.77	9.49 (2.7)	2.96†
	Moderate/a lot	18.43 (3.4)		10.69 (3.3)	
Perceived BRCA1/2 risk	Likely	18.52 (3.5)	0.31	10.42 (3.3)	1.27
	Not likely	19.00 (2.7)		9.38 (2.4)	

** $p < .01$, * $p < .05$, † $p < .10$

‡kruskal-wallis chi square with 1 df

Table 3. Association between Genetic Testing Intentions and Sociodemographic Characteristics, Clinical Factors, and Perceived Risk and Control (n=74)

Variable	Level	% Considering	Chi Square
Sociodemographics and Clinical Factors			
Prior blood sample	Yes No	82% 65%	1.20
Age	<= 50 > 50	78% 56%	3.92*
Marital status	Married Not married	72% 64%	0.51
Education level	> Some college <= High school	68% 67%	0.01
Employment status	Employed Not employed	68% 67%	0.01
Income level	> \$35,000 <= \$35,000	72% 65%	0.42
Cancer history	Affected Unaffected	66% 72%	0.23
Family history of cancer	2 or more Less than 2	78% 53%	5.37*
BRCA1/2 risk level	High Moderate	78% 57%	3.94*
Beliefs about Cancer			
Screening creates fear	True False	76% 54%	4.02*
Cancer cannot be prevented	True False	77% 61%	1.91
Perceived Risk and Control			
Perceived breast cancer risk	Higher/much higher Lower/same	70% 68%	0.04
Perceived control	None/a little Moderate/a lot	62% 74%	1.37
Perceived BRCA1/2 risk	Likely Not likely	81% 42%	11.67***

*** $p < .001$; ** $p < .01$, * $p < .05$

Table 4. Regression Model of Testing Intentions and Attitudes about the Limitations and Risks of Genetic Testing (n=74)^{##}

Outcome Variable	Predictor Variable	Level	OR	95% CI
Intentions	Prior blood sample	Yes	0.61	0.09, 3.93
		No	1.00	
	Beliefs about cancer screening	True	5.07	1.42, 18.12
		False	1.00	
	Number of relatives affected with cancer	Two or more	4.31	1.28, 14.54
		Less than two	1.00	
	Perceived risk of BRCA1/2	Likely	7.48	2.10, 26.60
		Not likely	1.00	
Cons^a	Prior blood sample	Yes	1.25	0.32, 4.91
		No	1.00	
	Cancer history	Affected	4.07	1.10, 15.06
		Unaffected	1.00	
	Perceived risk of developing breast cancer	Higher/much higher	2.84	1.04, 7.74
		Lower/same	1.00	

^amedian = 9.00^{##}variables included in the final model.

Figure 1. Attitudes about the Benefits of Genetic Testing

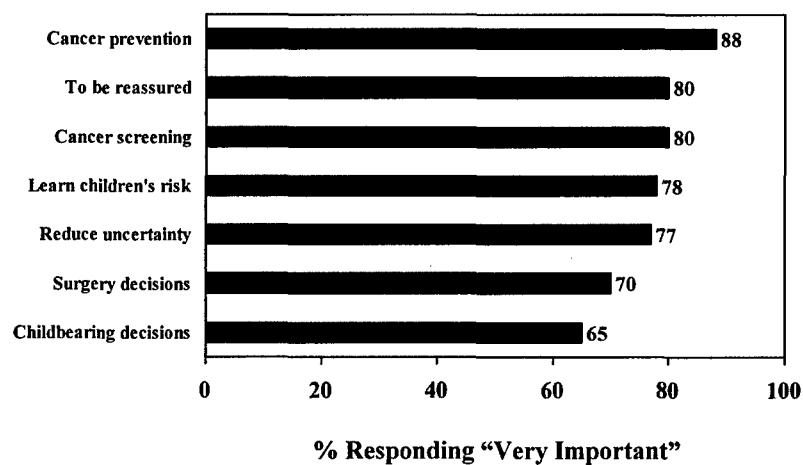
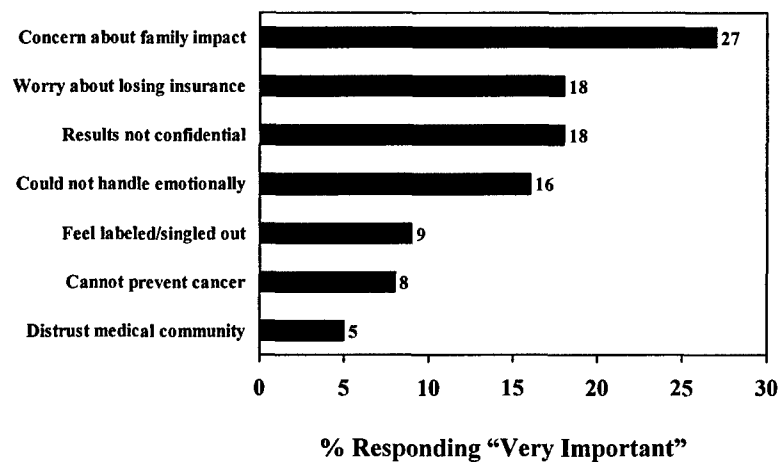


Figure 2. Attitudes about the Limitations and Risks of Genetic Testing



Decisions and outcomes of genetic testing for inherited breast cancer risk

C. H. Halbert*

Abramson Cancer Center and Department of Psychiatry, University of Pennsylvania, Philadelphia, PA, USA

Since the discovery of breast cancer susceptibility genes and the availability of genetic testing, a substantial amount of research has been conducted to evaluate rates of genetic test acceptance and to understand the psychological and behavioral impact of *BRCA1* and *BRCA2* (*BRCA1/2*) genetic test results. This article explores findings related to genetic test acceptance for inherited breast cancer risk and the impact of genetic test results on psychological functioning, cancer prevention and control behaviors, and family communication about genetic testing. Overall, rates of genetic test acceptance were lower than anticipated based on interest in genetic testing reported in early research. While there is limited evidence that genetic testing generates adverse psychological effects, receiving positive *BRCA1/2* test results may cause emotional reactions and concerns that are specific to such results. Although early reports suggested that receiving positive *BRCA1/2* test results may have a limited impact on cancer screening or prevention behaviors, recent studies have shown that genetic testing for inherited breast cancer risk may increase screening behaviors among mutation carriers. However, utilization of some screening tests remains low among mutation carriers. Additional studies are needed to identify subgroups of participants in genetic testing who may be vulnerable to experiencing testing-specific concerns, and to evaluate the effects of interventions designed to promote behavioral change and address other concerns that may be generated by receiving positive *BRCA1/2* test results.

Key words: breast cancer, family communication, genetic testing

Introduction

Susceptibility genes for both breast and ovarian cancer have been discovered [1, 2], and it is now possible for individuals to learn whether they carry a cancer-predisposing mutation for breast cancer. If found to carry a risk conferring *BRCA1* or *BRCA2* (*BRCA1/2*) mutation, women have an estimated 55–85% increased risk of developing breast cancer and a 15–60% increased risk of developing ovarian cancer [3–5]. Since the discovery of breast cancer susceptibility genes and the availability of genetic testing, a substantial amount of research has been conducted to evaluate rates of genetic test acceptance and to understand the psychological and behavioral impact of genetic test results. Because *BRCA1/2* mutations are transmitted through autosomal dominant transmission and test results have implications for relatives, a number of studies have also evaluated whether genetic test results are communicated to family members, and the process of disseminating genetic risk information to relatives.

The objective of this paper is to synthesize research on decisions and outcomes of genetic testing for inherited breast

cancer risk. First, existing data on acceptance of genetic testing for *BRCA1/2* mutations are reviewed. Following this, data on rates of family communication about genetic testing and the process of sharing risk information with relatives are reviewed. Next, data on the psychological and behavioral impact of genetic testing are presented, and included in this discussion are studies that have evaluated cancer screening and prevention behaviors following genetic testing. Lastly, suggestions for topics for future research on the outcomes of genetic counseling and testing are presented.

Rates of genetic test acceptance

Although a number of studies that were conducted before the availability of genetic testing for *BRCA1/2* mutations suggested a high level of interest in genetic testing for inherited cancer risk, uptake of genetic testing has been lower than anticipated in some settings. For example, in one study, while more than three-quarters of individuals at low and high risk for developing breast cancer reported that they would definitely have genetic testing for inherited breast cancer risk when it became available [6–8], only 43% of all high-risk individuals identified from extended hereditary breast cancer families participated in genetic counseling and received *BRCA1* test results [9]. Uptake of genetic testing was slightly higher (60%) among individuals who completed a telephone

*Correspondence to: Dr C. H. Halbert, Abramson Cancer Center and Department of Psychiatry, University of Pennsylvania, 3535 Market Street, Suite 4100, Philadelphia, PA 19104, USA. Tel: +1-215-746-7144; Fax: +1-215-746-7140; E-mail: chanita@mail.med.upenn.edu

interview as part of this study. Similar results were reported in another study that also included high-risk individuals identified from extended hereditary breast cancer families [10]. In this study, of 244 individuals who were invited to participate in genetic counseling and testing, 55% participated in counseling and had genetic testing. However, uptake of genetic testing (78%) was higher among individuals who participated in pre-test education and counseling ($n=172$; 70% of the 244 eligible subjects) in this study. Genetic test acceptance rates were higher in a clinic-based study; Schwartz et al. [11] reported that 82% of 290 newly identified high-risk women diagnosed with breast and/or ovarian cancer had genetic testing and received *BRCA1/2* test results. However, a much smaller proportion of high-risk women who were offered genetic testing through a clinical testing program received *BRCA1/2* test results. Of 258 high-risk individuals who were offered genetic testing in a clinical setting, only 26% had genetic testing and received *BRCA1/2* test results [12].

Psychological impact of genetic testing

The potential for genetic testing for inherited cancer susceptibility to generate adverse psychological reactions has been considered to be a risk of undergoing testing [13]. However, the evidence as to whether genetic testing has an adverse effect on psychological functioning is varied, with some studies reporting no significant effects on general distress [9, 14] and other studies revealing psychological difficulties specific to genetic test results [15, 16]. For example, one study that evaluated the short-term impact of genetic testing for *BRCA1/2* mutations among members of extended hereditary breast cancer families [9] found that receiving positive *BRCA1/2* test results did not lead to increases in depressive symptoms and that receiving negative test results was associated with a decrease in depressive symptoms. Similar results were reported by Croyle et al. [14]; in this study, individuals who received negative *BRCA1/2* test results reported significant decreases in anxiety 1 week following test results disclosure, and there was no change in anxiety levels among those who received positive *BRCA1/2* test results.

Similar findings have been reported in studies that included longer-term evaluations of psychological functioning following genetic testing. For example, Schwartz et al. [17] also did not find significant changes in anxiety or depression symptoms from baseline to 6-month follow-up between affected probands who were *BRCA1/2* mutation carriers and those who were not found to carry a deleterious gene alteration (e.g. uninformative). However, unaffected family members who received negative *BRCA1/2* test results exhibited significant decreases in cancer-specific distress from baseline to 6-month follow-up compared with those who received positive test results. In another study, which evaluated psychological functioning 5 years following disclosure of *BRCA1/2* test results, mutation carriers and non-carriers were not significantly different in terms of general or cancer-specific distress [18]. Moreover, even though both carriers and non-carriers in this study showed significant increases in depression and anxiety

1–5 years post-testing, levels of distress were not of a magnitude that would indicate clinical intervention [18].

While the data presented above suggest that genetic testing for inherited breast cancer risk does not generate adverse psychological reactions in terms of general or cancer-related distress, other studies have demonstrated that receiving positive *BRCA1/2* test results may generate specific concerns related to genetic test results. For example, using an instrument that was designed to evaluate concerns and reactions that are specific to genetic testing for *BRCA1/2* mutations, Cella et al. [15] found that compared with women who received negative test results, those who received positive *BRCA1/2* test results reported significantly greater levels of adverse emotional reactions such as sadness or nervousness, and uncertainty about the clinical and familial implications of their genetic test results 1 month following test result disclosure. Similar results were reported in terms of perceptions of stress regarding decisions about cancer screening and prevention and communicating genetic test results to family members among affected probands enrolled in a genetic testing and counseling research program [19]. In this study, probands who were found to carry a deleterious *BRCA1/2* mutation reported significantly greater perceptions of stress surrounding making medical decisions and managing familial concerns 1 month following test result disclosure compared with probands who were not found to carry a deleterious *BRCA1/2* gene alteration.

Family communication about genetic testing

Because genetic test results can provide important cancer risk information to family members, the familial impact of genetic testing for inherited cancer risk has been recognized as an important issue in genetic testing. For example, *BRCA1/2* mutations are transmitted through autosomal dominant transmission, and first-degree relatives of *BRCA1/2* mutation carriers have a 50% risk of testing positive for the gene alteration identified in a family member, whereas offspring of individuals who do not have a gene alteration are not at risk for having an inherited alteration in most cases. Policy guidelines recommend that risks to family members be emphasized as part of genetic counseling [20]; in most clinical programs, genetic counseling and testing are offered to family members after a risk-conferring *BRCA1/2* gene alteration has been detected in an index cancer patient (i.e. proband). Thus, access to genetic counseling and testing programs among unaffected family members may depend on whether genetic test results are communicated to relatives.

Several studies have shown that rates of communicating *BRCA1/2* test results to family members are high. For example, more than 80% of carriers and non-carriers identified from a hereditary breast cancer registry communicated their *BRCA1/2* test results to a sister 1 month following test results disclosure, and more than 70% of carriers and non-carriers communicated their *BRCA1/2* test results to an adult child [21]. Comparable rates of communicating results to sisters were found among high-risk men and women recruited to

participate in a clinic-based study of genetic counseling and testing [22]. Rates of communicating *BRCA1/2* test results to adolescent children were also comparable in clinic- and registry-based studies, but were lower (46–53%) than rates of communicating results to siblings and adult children [21, 23]. These studies suggest that most individuals who have received *BRCA1/2* test results share this information with family members; however, communication of genetic risk information to family members may depend on kinship type, with individuals most likely to communicate their *BRCA1/2* test results to a sister and least likely to communicate their genetic test results to an adolescent child under the age of 13 years.

Recent studies have also evaluated the process and impact of communicating *BRCA1/2* test results to family members. For example, in terms of communicating *BRCA1/2* test results to sisters, a recent study found that probands communicated their genetic test results to most sisters within 1 week of completing the test results disclosure session, and the most important motivations for sharing genetic test results was to provide sisters with information about their risk of having a *BRCA1/2* gene alteration and to obtain emotional support [24]. However, other work has shown that communicating results to family members may be a stressor for mutation carriers [25, 26]. Thus, although providing cancer risk information for family members may be a strong motivation for undergoing genetic testing [9], communicating genetic risk information to relatives may be a difficult process in some cases.

Cancer screening and prevention behaviors

While the possibility for genetic risk information to have an adverse effect on psychological functioning has been considered to be a risk of undergoing genetic testing, the potential for this information to lead to increased use of cancer screening tests and to facilitate more informed decisions about cancer prevention has been reported to be a possible benefit among individuals considering genetic testing [9]. Screening recommendations for *BRCA1/2* mutation carriers include more frequent surveillance and consideration of prophylactic surgery [27]. However, findings on the impact of genetic test results on utilization of cancer screening tests and preventive surgery have been mixed. For example, although *BRCA1/2* mutation carriers enrolled in a registry-based study reported significantly greater rates of mammography utilization during the year following genetic testing compared with non-carriers, mammography utilization rates were unchanged after genetic testing among mutation carriers [28]. Before genetic testing and during the year following test result disclosure, 68% of mutation carriers reported having a mammogram [28]. However, in a recent study that included 189 unaffected female members of a *BRCA1* kindred, 82% of mutation carriers had obtained a mammogram during the first and second year following genetic testing; both carriers and non-carriers reported significantly increased utilization of mammography from baseline to 1 and 2 years post-testing [29]. However, there were no differences in mammography utilization among test result groups at 1 or 2 years post-genetic testing in this study, and

no mutation carriers had obtained a prophylactic mastectomy during the 2 years following test results disclosure.

Similar trends have been reported for utilization of ovarian cancer screening tests, with early studies reporting low rates of CA-125 and transvaginal ultrasound use during the year following genetic testing among mutation carriers, and more recent studies demonstrating greater utilization of ovarian cancer screening tests. For example, 15% of mutation carriers identified from extended hereditary breast cancer families reported having a CA-125 test and 21% reported having a transvaginal ultrasound during the year following genetic testing [28], whereas ~40% of mutation carriers without a prior history of ovarian cancer or surgery enrolled in a clinic-based study obtained a CA-125 test and transvaginal ultrasound during the year following genetic testing [30]. The clinic-based study, conducted by Schwartz et al. [30], also found that *BRCA1/2* mutation carriers were significantly more likely than non-carriers to report increased utilization of ovarian cancer screening, and were also more likely to report having a bilateral prophylactic oophorectomy following genetic testing.

Implications for future research

Increasingly, genetic counseling and testing for inherited breast cancer susceptibility are being integrated into the clinical management of individuals who have a family history of breast cancer that is suggestive of hereditary disease. Early studies, conducted before the availability of genetic testing, indicated a high level of interest in genetic testing [6–8]; the available data indicate that many high-risk individuals elect to undergo genetic counseling and testing for inherited cancer risk. Rates of genetic test acceptance for *BRCA1/2* mutations range from 26% to 82% in clinic- and registry-based studies [9–12]. However, an important consideration with respect to utilization of genetic testing may be the setting in which counseling and testing are offered and the population targeted for participation in these programs. For example, it is possible that the higher rates of genetic test acceptance observed in the study conducted by Schwartz et al. [11] were due to the fact that this study targeted newly identified high-risk women who were affected with breast and/or ovarian cancer and self-referred to a genetic testing research program. Such patients may be more motivated than members of extended hereditary breast cancer families who are enrolled in a cancer registry to undergo genetic counseling and receive *BRCA1/2* test results. While newly identified, high-risk individuals may be more motivated to undergo genetic testing, payment for genetic counseling and testing may also be an important factor in testing decisions. Overall, utilization of genetic counseling and testing has been evaluated as part of research protocols in which both counseling and testing were provided free of charge [9–11]. Genetic test acceptance rates were lowest in a clinical setting in which testing was not provided free of charge to all participants. Only 26% of high-risk individuals received *BRCA1/2* test results in a study conducted in a clinical genetic testing program, and a significant predictor of genetic test acceptance was access to free genetic testing [12].

Thus, the utilization rates observed in research settings may overestimate genetic test acceptance in clinical settings where individuals may be required to pay as much as US \$2800 for these services. Additional studies are needed to evaluate utilization of genetic testing in clinic and community settings.

With respect to the psychological impact of genetic testing for inherited breast cancer risk, the emerging data suggest that genetic testing for inherited *BRCA1/2* mutations does not generate adverse psychological reactions. In both clinic- and registry-based studies, there was no evidence that receiving positive *BRCA1/2* test results leads to short- or long-term increases in general or cancer-specific distress [9, 14, 17]. In addition, from a recent review of psychological outcomes following genetic testing for *BRCA1/2* mutation, Butow et al. [31] suggested that for the most part, genetic counseling and testing for *BRCA1/2* mutation appears to have some psychological benefit. While one conclusion may be that genetic testing for inherited breast cancer risk does not generate adverse psychological reactions, an important consideration is that levels of distress may still be moderately higher among mutation carriers compared with non-carriers following test result disclosure [17, 18]. Moreover, even though prior studies have shown that levels of distress among high-risk individuals may not be at levels where clinical intervention is warranted [18, 32], there is some evidence that *BRCA1/2* mutation carriers may experience greater levels of testing-specific distress, such as uncertainty about the clinical and familial implications of their test results, compared with individuals who are not found to carry a deleterious gene alteration [15, 16]. However, several studies have shown that individuals who have received *BRCA1/2* test results communicate their genetic risk information to family members shortly after test result disclosure [21, 22, 24, 26]. Furthermore, recent studies have also reported increased utilization of cancer screening tests and preventive surgery among mutation carriers following genetic testing [29, 30]. It may be that while sharing genetic test results with family members may be a relatively straightforward process [33], dealing with the reactions from family members may be more complex. Previous research has shown that probands who were *BRCA1/2* mutation carriers reported greater difficulty communicating their results to family members, and were more likely than non-carriers to report that their relatives were upset upon being told that a deleterious *BRCA1/2* gene alteration had been identified [26]. Data from qualitative studies also suggest that probands may not be prepared to handle negative reactions from family members [25, 34]. This may explain greater levels of uncertainty about the familial impact of *BRCA1/2* test results reported among mutation carriers in prior studies [15]. These studies suggest that *BRCA1/2* mutation carriers may benefit from post-test interventions that are designed to address the familial impact of genetic testing for inherited breast cancer risk. However, additional studies are needed to understand testing-specific concerns among more diverse samples of *BRCA1/2* mutation carriers and to identify mutation carriers who are most and least likely to experience these reactions. Future studies

should also evaluate changes in testing-specific concerns over longer periods of time following test results disclosure.

While data from recent studies [29, 30] provide some evidence that genetic test results may promote increased use of cancer screening and may facilitate decisions about cancer prevention among *BRCA1/2* mutation carriers, rates of cancer screening and prevention may still be low following test results disclosure. For example, less than half of *BRCA1/2* mutation carriers identified from a clinic-based research study reported having ovarian cancer screening during the year following genetic testing [30]. Other studies have shown that more than half of *BRCA1/2* mutation carriers aged 35 years and older had a prophylactic oophorectomy shortly after genetic testing [35]; however, in other research only 27% of *BRCA1/2* mutation carriers reported having a prophylactic oophorectomy and less than half reported having ovarian cancer screening during the year following genetic testing [30]. Data on the efficacy of risk reduction and screening options among *BRCA1/2* mutation carriers are now emerging [35–37]; it is possible that mutation carriers need additional support following test result disclosure to integrate this complex information into their risk management plans. Interventions are now being developed to facilitate effective medical decision-making among high-risk women and *BRCA1/2* mutation carriers [38, 39]; the results of these studies will provide important information on decisions about screening and preventive surgery among this population.

Acknowledgements

This work was supported by Department of Defense grant DAMD17-00-1-0262 and by grant HG01846 from the National Human Genome Research Institute.

References

1. Miki Y, Swensen J, Shattuck-Eidens D et al. A strong candidate for the breast and ovarian cancer susceptibility gene *BRCA1*. *Science* 1994; 226: 66–71.
2. Wooster R, Bignell G, Lancaster J et al. Identification of the breast cancer susceptibility gene *BRCA2*. *Nature* 1995; 378: 789–792.
3. Easton DF, Ford D, Bishop T. The Breast Cancer Linkage Consortium. Breast and ovarian cancer incidence in *BRCA1*-mutation carriers. *Am J Hum Genet* 1995; 56: 265–271.
4. Ford D, Easton DF, Stratton M et al. Genetic heterogeneity and penetrance analysis of the *BRCA1* and *BRCA2* genes in breast cancer families. *Am J Hum Genet* 1998; 62: 676–689.
5. Struwing JP, Hartge P, Wacholder S et al. The risk of cancer associated with specific mutations of *BRCA1* and *BRCA2* among Ashkenazi Jews. *N Engl J Med* 1997; 336: 1401–1408.
6. Chaliki H, Loader S, Levenkron JC et al. Women's receptivity to testing for a genetic susceptibility to breast cancer. *Am J Public Health* 1995; 85: 1133–1135.
7. Lerman C, Seay J, Balshem A, Audrain J. Interest in genetic testing among first-degree relatives of breast cancer patients. *Am J Med Genet* 1995; 57: 385–392.
8. Struwing JP, Lerman C, Kase RG et al. Anticipated uptake and impact of genetic testing in hereditary breast and ovarian cancer families. *Cancer Epidemiol Biomarkers Prev* 1995; 4: 169–173.

9. Lerman C, Narod S, Schulman K et al. BRCA1 testing in families with hereditary breast-ovarian cancer. A prospective study of patient decision making and outcomes. *JAMA* 1996; 275: 1885-1892.
10. Biesecker BB, Ishibe N, Hadley DW et al. Psychosocial factors predicting BRCA1/BRCA2 testing decisions in members of hereditary breast and ovarian cancer families. *Am J Med Genet* 2000; 93: 257-263.
11. Schwartz MD, Hughes C, Roth J et al. Spiritual faith and genetic testing decisions among high-risk breast cancer probands. *Cancer Epidemiol Biomarkers Prev* 2000; 9: 381-385.
12. Lee SC, Bernhardt BA, Helzlsouer KJ. Utilization of BRCA1/2 genetic testing in the clinical setting: report from a single institution. *Cancer* 2002; 94: 1876-1885.
13. Biesecker B, Boehnke M, Calzone K et al. Genetic counseling for families with inherited susceptibility to breast and ovarian cancer. *JAMA* 1993; 269: 1970-1974.
14. Croyle RT, Smith KR, Botkin JR et al. Psychological responses to BRCA1 mutation testing: preliminary findings. *Health Psychol* 1997; 16: 63-72.
15. Cella D, Hughes C, Peterman A et al. A brief assessment of concerns associated with genetic testing for cancer: the multidimensional impact of cancer risk assessment (MICRA) questionnaire. *Health Psychol* 2002; 21: 564-572.
16. Dorval M, Patenaude AF, Schneider KA et al. Anticipated versus actual emotional reactions to disclosure of results of genetic tests for cancer susceptibility: findings from p53 and BRCA1 testing programs. *J Clin Oncol* 2000; 18: 2135-2142.
17. Schwartz MD, Peshkin BN, Hughes C et al. Impact of BRCA1/BRCA2 mutation testing on psychologic distress in a clinic-based sample. *J Clin Oncol* 2002; 20: 514-520.
18. van Oostrom I, Meijers-Heijboer H, Lodder LN et al. Long-term psychological impact of carrying a BRCA1/2 mutation and prophylactic surgery: a 5-year follow-up study. *J Clin Oncol* 2003; 21: 3867-3874.
19. Halbert CH, Schwartz MD, Wenzel L et al. Cognitive appraisals following genetic testing for BRCA1 and BRCA2 mutations. *J Beh Med* 2004; In press.
20. American Society of Clinical Oncology. Statement of the American Society of Clinical Oncology Policy Statement Update: Genetic Testing for Cancer Susceptibility. *J Clin Oncol* 2003; 21: 2397-2406.
21. Hughes C, Lynch H, Durham C et al. Communication of BRCA1/2 test results in hereditary breast cancer families. *Cancer Res Ther Control* 1999; 8: 51-59.
22. Lerman C, Peshkin BN, Hughes C, Isaacs C. Family disclosure in genetic testing for cancer susceptibility: determinants and consequences. *J Health Care Law Policy* 1998; 1: 353-372.
23. Tercyak KP, Peshkin BN, DeMarco TA et al. Parent-child factors and their effect on communicating BRCA1/2 test results to children. *Patient Educ Couns* 2002; 47: 145-153.
24. Hughes C, Lerman C, Schwartz M et al. All in the family: an evaluation of the process and content of sister's communication about BRCA1 and BRCA2 genetic test results. *Am J Med Genet* 2002; 107: 143-150.
25. Bonadona V, Saltel P, Desseigne F et al. Cancer patients who experienced diagnostic genetic testing for cancer susceptibility: reactions and behavior after the disclosure of a positive test result. *Cancer Epidemiol Biomarkers Prev* 2002; 11: 97-104.
26. Costalas JW, Itzen M, Malick J et al. Communication of BRCA1 and BRCA2 results to at-risk relatives: a cancer risk assessment program's experience. *Am J Med Genet* 2003; 119: 11-18.
27. Burke W, Daly M, Garber J et al. Recommendations for follow-up care of individuals with an inherited predisposition to cancer. *JAMA* 1997; 277: 997-1003.
28. Lerman C, Hughes C, Croyle RT et al. Prophylactic surgery decisions and surveillance practices one year following BRCA1/2 testing. *Prev Med* 2000; 31: 75-80.
29. Botkin JR, Smith KR, Croyle RT et al. Genetic testing for a BRCA1 mutation: prophylactic surgery and screening behavior in women 2 years post testing. *Am J Med Genet* 2003; 118: 201-209.
30. Schwartz MD, Kaufman E, Peshkin B et al. Ovarian cancer screening and prophylactic surgery in a clinic-based sample of women following BRCA1/2 testing. *J Clin Oncol* 2003; 21: 4034-4041.
31. Butow PN, Lobb EA, Meiser B et al. Psychological outcomes and risk perception after genetic testing and counseling in breast cancer: a systematic review. *Med J Aust* 2003; 178: 77-81.
32. Coyne JC, Benazon NR, Gaba CG et al. Distress and psychiatric morbidity among women from high-risk breast and ovarian cancer families. *J Consult Clin Psychol* 2000; 68: 864-874.
33. Peterson SK, Watts BG, Koehly LM et al. How families communicate about HNPCC genetic testing. *Am J Med Genet* 2003; 119: 78-86.
34. Speice J, McDaniel SH, Rowley PT, Loader S. Family issues in a psychoeducation group for women with a BRCA mutation. *Clin Genet* 2002; 62: 121-127.
35. Kauf ND, Satagopan JM, Robson ME et al. Risk-reducing salpingo-oophorectomy in women with a BRCA1 or BRCA2 mutation. *N Engl J Med* 2002; 346: 1609-1615.
36. Rebbeck TR, Lynch HT, Neuhausen SL et al. Prophylactic oophorectomy in carriers of BRCA1 or BRCA2 mutations. *N Engl J Med* 2002; 346: 1616-1622.
37. Hartmann LC, Sellers TA, Schaid DJ et al. Efficacy of bilateral prophylactic mastectomy in BRCA1 and BRCA2 gene mutation carriers. *J Natl Cancer Inst* 2001; 93: 1633-1637.
38. Kaufman EM, Peshkin BN, Lawrence WF et al. Development of an interactive decision aid for female BRCA1/BRCA2 carriers. *J Genet Couns* 2003; 12: 109-129.
39. Tiller K, Meiser B, Reeson E et al. A decision aid for women at increased risk for ovarian cancer. *Int J Gynecol Cancer* 2003; 13: 15-22.

**ABSTRACT – PAPER TO BE PRESENTED AT THE SOCIETY OF BEHAVIORAL
MEDICINE ANNUAL SCIENTIFIC CONFERENCE, BOSTON, MA, APRIL 2005**

Recruiting African American Women to Participate in Hereditary Breast Cancer Research

**Chanita Hughes Halbert, Ph.D., Kiyona Brewster, MA, Aliya Collier, BA, Lisa Kessler,
MS, CGC, Benita Weathers, MPH, University of Pennsylvania**

Recommendations for improving African American participation in medical research include targeting community resources and using personalized recruitment strategies; however, limited information is available on the effectiveness of these approaches for recruiting African American women to participate in hereditary breast cancer research. The purpose of this study was to evaluate the yield of eligible women identified from community and clinical sources and to describe rates of enrollment in a genetic counseling study among African American women at increased risk for hereditary breast cancer. Bivariate analyses were conducted to evaluate the association between clinical factors, recruitment procedures, and enrollment decisions. Logistic regression analysis was conducted to identify factors having independent associations with enrollment. A total of 788 women were screened; of these, 168 (21%) were eligible for participation. Eligible women were most likely to be identified from oncology clinics (44%) compared to community resources (23%) and general practices (11%) (Chi Square=96.80, $p=.0001$). Overall, 62% of eligible women enrolled in the study. Women who had two or more relatives affected with cancer were twice as likely to enroll in the study compared to women who had fewer affected relatives (OR=2.32, 95% CI=1.15, 4.66, $p=.02$). Women recruited from oncology clinics and community resources were also about four times more likely to enroll compared to those recruited through general medical practices (OR=3.88, 95% CI=1.89, 7.98, $p=.002$). These results suggest that African American enrollment in genetic counseling research may be motivated by the recruitment setting and familial experiences with cancer.

**ABSTRACT – PAPER TO BE PRESENTED AT THE AMERICAN COLLEGE OF
MEDICAL GENETICS CONFERENCE, DALLAS, TX, MARCH 2005**

**Factors Associated with Participation in Cancer Genetic Counseling among African
American Women**

Kessler L, Collier A, Brewster K, Smith C, Weathers B, Halbert CH

Increasingly, efforts are being directed towards increasing access to genetic counseling for *BRCA1* and *BRCA2* (*BRCA1/2*) mutations among African American women. However, few studies have explored participation in genetic counseling among African American women at increased risk for hereditary breast cancer. The purpose of this study was to evaluate rates of participation in genetic counseling among African American women at high and moderate risk for *BRCA1/2* mutations and to identify sociodemographic, clinical, and psychological factors that are associated with acceptance of genetic counseling. Participants were 95 African American women who completed a baseline telephone interview and who had a minimum 5% to 10% prior probability of having a *BRCA1/2* mutation. Sociodemographic characteristics, clinical factors, and psychological variables were evaluated during a baseline telephone. Logistic regression analysis was conducted to identify factors having independent associations with acceptance of genetic counseling. Overall, 53% of women participated in genetic counseling and 47% declined. Women with some college education and college graduates were three times more likely to participate in genetic counseling compared to those with less education (OR=3.27, 95% CI=1.24, 8.60, $p=.02$). In addition, women with a higher prior probability of having a *BRCA1/2* mutation were about two times more likely to participate in genetic counseling compared to those at moderate risk (OR=2.77, 95% CI=1.12, 6.86, $p=.03$). No other sociodemographic, clinical factors, or psychological variables were associated significantly with participation. These results suggest that while participation in genetic counseling may be limited

among African American women, women with greater education and those at higher risk for having a BRCA1/2 mutation may be most likely to participate in genetic counseling.